vulnerable part of the blade system, namely, the free portion of the blades.

The dummy pistons each have a diameter equal to the mean diameter of the blading on that section of the turbine they are to balance. To prevent steam leakage past them they have what is known as a " labyrinth packing ". This is shown in detail in fig. 16.

The general practice in order to avoid strains on the turbine casing from expansion of the condenser body is to mount the condenser on springs. The condenser can then be bolted direct to the exhaust flange of the turbine, and expands downwards on to the springs when heated up.

CHAPTER VI

Rateau Turbines

ERASER & CHALMERS' DESIGN

Messrs. Eraser & Chalmers were the first builders of multi-stage impulse turbines in this country. Their original designs were built under licence from Professor Rateau, and were of the pure multi-pressure stage type. Later they, in common with many other turbine builders, adopted a velocity wheel for the first stage where conditions warranted its use, but they adhere to the pure pressure-stage design if steam conditions, &c., are such as to produce a more favourable design with this arrangement. Fig. 17 shows a 20,ooo-Kw. turbine running at 1500 r.p.m. having one velocity wheel, and single pressure stages for all lower stages. The last stages are arranged on the double-flow principle to avoid the excessively large disc diameters and the blade lengths which would otherwise be required efficiently to handle the steam at the high vacuum which this machine is intended to utilize. It will be seen that after the eleventh stage the steam path is divided, part of the steam passing through three more stages to the condenser, the remainder being carried by means of volutes and connecting passages to a two-stage system, the discs of which

are of considerably greater diameter than those of the three stages with which they work in parallel. The profile of these two discs is so designed as to keep the factor of safety as high as in the three smaller discs. The diameter is, of course, still far below that which would be required in a corresponding single-flow design.

The high-pressure end of the casing is made of cast steel where the temperature of the ste^m warrants its use. Otherwise cast iron of special high-grade and homogeneous quality is employed. The exhaust end is fixed to the bedplate, and the high-pressure end is kept free to slide on guides to allow for heat expansion.

The discs are machined from solid forgings, and after the blades are assembled and the individual complete wheels are balanced, they are tested under steam in a special machine at a speed well above the normal. This